

ON A SMALL COLLECTION OF DRAGONFLY KARYOTYPES FROM THE PHILIPPINES

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From 3 localities in the Luzon Island the male germ cell complements were examined of the following 8 spp., 3 of which (asterisked) are new to cytology: Coenagrionidae: *Agriocnemis f. femina* (Brauer)* (n=14), *Ischnura senegalensis* (Ramb.) (n=14), *Pseudagrion microcephalum* (Ramb.) (n=14, m), *P. rubriceps* Sel. (2n=27, m); Chlorocyphidae: *Rhinocypha c. colorata* Sel.* (2n=25, n=13 [?], 12 [?], m); Libellulidae: *Crocothemis servilia* (Dru.) (n=13, m), *Neurothemis terminata* Ris* (n=13, m), and *Trithemis pallidinervis* (Kirby) (n=13, m). The Philippine population of *I. senegalensis* is the first of this sp. in which the m-chromosomes are definitely lacking; the geographic variation in the TCL of this taxon is briefly outlined.

INTRODUCTION

The tropical depression "Karing" allowed us to collect only a few "tutubi" (i.e. the Philippine expression for "dragonfly" in the Tagalog language; "tubi" = "water") during our brief stay in the Philippines (May 12-16, 1979), and only three collecting sites could be visited, viz. a city park in Manila, the village of Pila, and the Pagsanjan Falls (the latter two in the Laguna Province; all Luzon Island).

The collection includes nine species, referable to four families, but one of these (a *Risocnemis*) will be dealt with in a separate paper. Dr. M.A. LIEFTINCK (Rhenen, the Netherlands), who this time again very kindly identified our material, is working on its morphological redescription, and the (peculiar) karyotype will be brought on record along with his morphological notes. The remaining species are all common and wide-spread in the

Philippines (cf. NEEDHAM & GYGER, 1937, 1939), but *Agriocnemis f. femina*, *Rhinocypha c. colorata* and *Neurothemis terminata* have not been previously examined cytologically.

Of most of the species treated here no micrographs were published earlier, and some of our observations are either complementary to or in disagreement with the hitherto available evidence. The latter holds true of, respectively, *Crocothemis servilia* and *Trithemis pallidinervis*.

Of particular interest is the Philippine population of *Ischnura senegalensis*, in which the *m*-chromosomes are lacking, whereas they have been reported for populations of Japanese, Indian and Ethiopian provenience (though in the latter case the *m*-pair is rather large).

The specimens, (Feulgen) slides and microfilms are in the authors' collection.

DESCRIPTIONS AND DISCUSSIONS OF THE KARYOTYPES

Coenagrionidae

AGRIOCNEMIS FEMINA FEMINA (BRAUER, 1868)

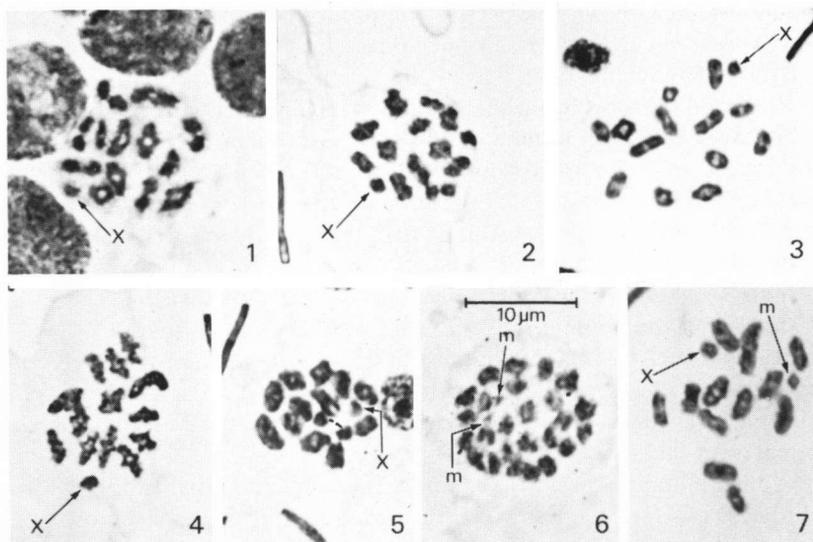
Figures 1-3

Material. — 5 ♂, Pila, Laguna Prov., 13-V-1979. — [44 complements photographed].

$n=14$. — The metaphase-I elements are of decreasing magnitude (Fig. 3). The smallest bivalent, which could hardly be called an *m*, and X are of similar size, X being the smallest of the spermatocyte-I set. The despiralisation often does not occur simultaneously and one or more bivalents tend to segregate precociously (Figs. 1, 2).

The general morphology of the karyotype resembles that of *A. clauseni* Fraser (cf. TYAGI, 1978b, p. 77 and fig. 100), while the smallest bivalent (*m*) is relatively much smaller in *A. pygmaea* (Ramb.) (cf. TYAGI, 1978b, p. 79). In the allied agriocnemine taxa the *m* is lacking in *Ceratura capreola* (Hag.) (CUMMING, 1964), while *Mortonagrion selenion* (Ris) possesses a very peculiar karyotype, with the X by far the largest of the set at metaphase I. In KICHIJO's (1942) figures of this species one of the autosomes (not the smallest one!) is indicated as an "m", but it is by no means inferior in size to all other bivalents. No other members of the subfamily have so far been examined cytologically.

The karyotypic morphology of the group, thus, shows considerable variation, though both the chromosome number and the recombination potential seem to be stabilized.



Figs. 1-7. Male germ cell chromosomes of Coenagrionidae (Feulgen squash, 1500 X): (1-3) *Agriocnemis f. femina* (Brauer), various stages of metaphase I (note the tendency to precocious segregation in one or more bivalents in Figs 1 and 2); — (4-5) *Ischnura senegalensis* (Ramb.): (4) early metaphase I, (5) metaphase I, with a precociously segregated bivalent (dotted line); — (6-7) *Pseudagrion microcephalum* (Ramb.): (6) spermatogonial metaphase, (7) metaphase I.

ISCHNURA SENEGALENSIS (RAMBUR, 1842)

Figures 4-5

Material. — 4 ♂, Manila (Rizal Park), 15-V-1979. — [66 complements photographed].

$n=14$. — Contrary to the situation reported by various workers for material from Japan, India and Ethiopia (for references cf. below), in our Philippine individuals there are no *m*-chromosomes and X is clearly the smallest element at metaphase I (Fig. 4). In less than 10% of figures of this stage, one of the smaller bivalents segregates precociously (Fig. 5). A tendency to precocious segregation (of some bivalents) is apparent also in the Ethiopian material (cf. KIAUTA, 1969, fig. 2), though the actual segregation has not been evidenced.

Among twelve $n=14$ *Ischnura* species so far cytologically examined (for a review cf. KIAUTA, 1972; additional species: KIAUTA & VAN BRINK, 1978), *I. senegalensis* is the only one in which the *m*-chromosomes were ever reported, though an *m*-bivalent does occur in the $n=15$ complement of *I. pumilio* (Charp.) (KIAUTA, 1979). There is, however, either a certain controversy at this point, or the size of the small bivalent varies considerably on the geographic population level. The following evidence has been hitherto

brought on record with respect to the occurrence and relative size of the *senegalensis* *m*-chromosomes at metaphase I:

— Japan, KICHIO (1942, figs 24-26): a rather large *m* is clearly inferior in size to X, while it is by far the smallest at metaphase II (figs. 27-28). (There are other papers by Kichijo on this species, but they seem to be based on the same material; for references cf. KIAUTA, 1972).

— India, DASGUPTA (1957, fig. 13): a very minute *m* is figured in diakinetid drawings, but it is apparently much larger (and its identity is unclear) in the metaphase-I figure.

India, TYAGI (1978b): the *m*-bivalent is clearly smaller than the X; it is stated that the observations are identical to those of Dasgupta.

— Ethiopia, KIAUTA (1969, fig. 2): the X and *m* are of approximately equal length, or the former is slightly shorter than the latter. The second smallest bivalent is not significantly larger than the one considered to represent the *m*.

The four Philippine specimens examined are, thus, essentially different from all that has so far been known on the occurrence of the *m*-chromosomes in this species. In the Philippines, *I. senegalensis* does not seem to possess an *m*-pair (bivalent), and it agrees in this feature with the 12 other *Ischnura* species studied. As far as the *m*-chromosomes are concerned, the genus appears remarkably uniform.

I. senegalensis has by far the widest geographic range of all the *Ischnura* taxa studied cytologically, and individuals have been examined from a wider geographic range than of any other member of the genus. It does not seem unreasonable to tentatively assume, therefore, that the pronounced variation in relative chromosome length represents an adaptive feature in this species.

PSEUDAGRION MICROCEPHALUM (RAMBUR, 1842)

Figures 6-7

Material. — 2 ♂, Manila (Rizal Park), 15-V-1979. — [33 complements photographed].

$2n=27$, $n=14$; *m*. — Little can be added to the karyotype description provided by DASGUPTA (1957). At metaphase I the largest bivalent is clearly discernible (Fig. 7). The spermatogonial *m*'s are minute, and the metaphase-I *m*-bivalent is about half the size of the X.

PSEUDAGRION RUBRICEPS SELYS, 1876

Material. — 1 ♂, Pila, Laguna Prov., 13-V-1979. — [2 complements photographed].

$2n=27$; *m*. — Our material is inadequate for any comparison with the

karyotype descriptions of Indian material published by DASGUPTA (1957) and TYAGI (1978b).

Chlorocyphidae

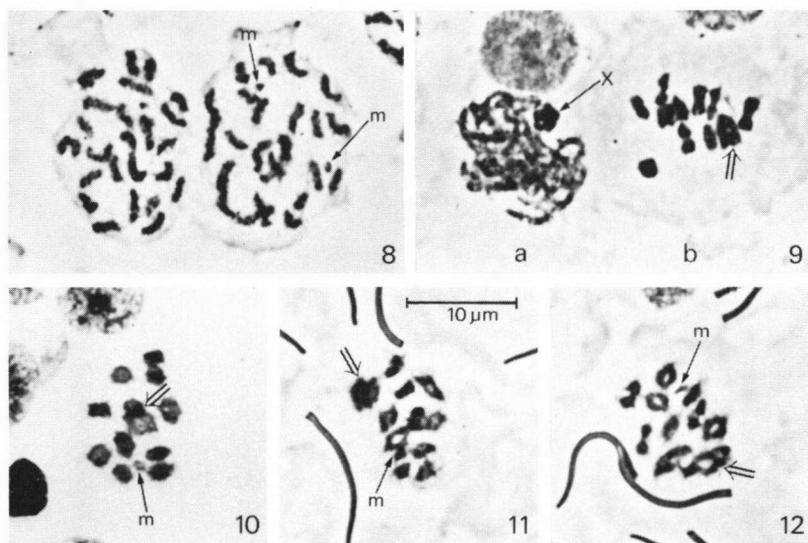
RHINOCYPHA COLORATA COLORATA SELYS, 1869

Figures 8-12

Material. — 1 ♂, Pagsanjan Falls, Laguna Prov., 13-V-1979. — [10 complements photographed].

$2n=25$, $n=13$ (?), 12 (?); *m.* — There are 25 elements in spermatogonial metaphase, including an *m*-pair. Two of the larger pairs are occasionally, but not always, joined in terminal regions (Fig. 8). In polar views of metaphase I, 13 elements occur. The identity of X is uncertain and two bivalents seem to be more or less joined to each other in all figures (cf. Figs. 9b, 10-12, double arrows). As apparent from the pachytene figures, the X is rather large (Fig. 9a). A single chiasma occurs per bivalent.

This is the seventh member of the genus so far examined (for a review cf. KIAUTA & KIAUTA, 1980), and the second species in which the chromosome number deviates from the family type number ($n=12$) (cf.



Figs. 8-12. Male germ cell chromosomes of *Rhinocypha c. colorata* Sel. (Feulgen squash, 1500 X): (8) two spermatogonial metaphases; — (9) pachytene (a), and early anaphase II (b) (note the large size of X); — (10-12) metaphase I. Arrows: joined bivalents.

KIAUTA, 1975, p. 42: *R. quadrimaculata* Sel.). Along with the cytologically little-known Polythoridae, the Chlorocyphidae are the only calopterygoid family with the type number lower than that of the Order (cf. CHATTERJEE & KIAUTA, 1973; KIAUTA, 1975; TYAGI, 1978a, 1978b).

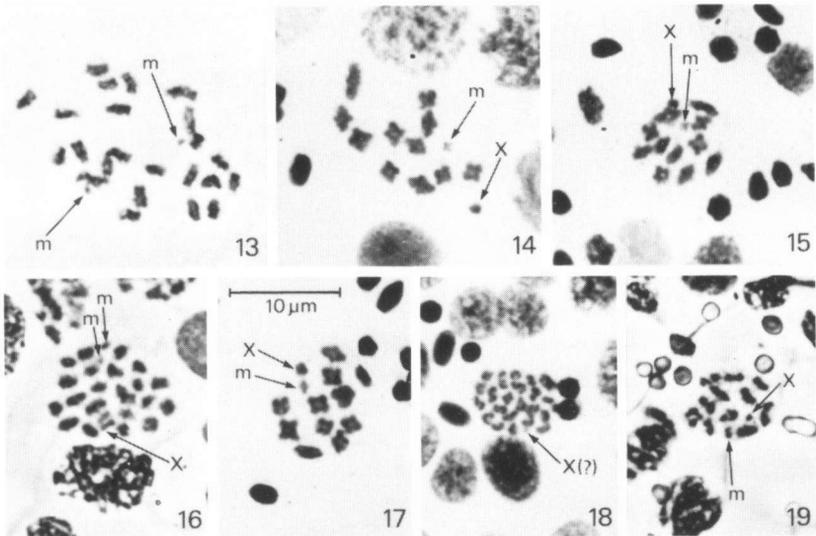
Libellulidae

CROCOTHEMIS SERVILIA (DRURY, 1773)

Figures 13-15

Material. — 2♂, Manila (Rizal Park), 15-V-1979. — [65 complements photographed]. — Morphologically, the two individuals show some minor structural differences, their karyotypes however are identic in all details.

$2n=25$, $n=13$; *m*. — No pair is peculiar by its superior size in spermatogonial metaphase; save for the *m*-pair, but including the X, the size gradation is small at this stage (Fig. 13). The lack of an appreciable difference in magnitude between the largest two pairs is in agreement with the karyotypes described from Bombay, Calcutta, New Delhi, Dehra Dun and



Figs. 13-19. Male germ cell chromosomes of Libellulidae (Feulgen squash, 1500 X): (13-15) *Crocothemis servilia* (Drury): (13) spermatogonial metaphase, (14-15) metaphase I; — (16-17) *Neurothemis terminata* Ris: (16) spermatogonial metaphase (note the precocious separation of X chromatids), (17) metaphase I; — (18-19) *Trithemis pallidinervis* (Kirby): (18) spermatogonial metaphase, (19) metaphase I.

Kurukshetra, all India (ASANA & MAKINO, 1935; RAY CHAUDHURI & DAS GUPTA, 1949; BAGGA, 1961; TYAGI, 1978b; and YADAV, 1979, resp.) and with that occurring in Nepal (Kiauta, unpublished). It goes without saying that the Japanese *servilia*, with a secondarily reduced complement and neo-XY sex determination, cannot be compared with the other Asiatic populations (cf. OMURA, 1955).

At metaphase I, in both individuals the chiasma terminalization in one of the larger bivalents is completed slightly (but regularly) precociously (Figs. 14-15). In the same bivalent, the segregation also is precocious. There is a single chiasma per bivalent without exception.

At the same stage, the *m*-bivalent is considerably smaller and thinner than the X. This feature is similar to the situation reported from Bombay (ASANA & MAKINO, 1935), New Delhi (BAGGA, 1961, pl. 3, fig. 1B) and Nepal (KIAUTA, 1975), while the two elements are of similar size in material from Calcutta (RAY CHAUDHURI & DAS GUPTA, 1949), Dehra Dun (TYAGI, 1978b) and Kurukshetra (YADAV, 1979).

NEUROTHEMIS TERMINATA RIS, 1911

Figures 16-17

Material. — 4 ♂, Manila (Rizal Park), 15-V-1979. — [66 complements photographed].

$2n=25$, $n=13$; *m*. — The spermatogonial metaphase elements are of gradually decreasing magnitude, save for a minute *m*-pair. The X is medium-sized and nearly always the two chromatids are separated at this stage (Fig. 16).

At metaphase I, the X is more than half smaller than the smallest "normal" bivalent, while the *m*-bivalent is minute (Fig. 17).

This is the fourth member of the genus so far examined. While 14 elements were encountered in the haploid set of the Indian *N. t. tullia* (Dru.) (RAY CHAUDHURI & DAS GUPTA, 1949; TYAGI, 1978b), the minuteness of the *m* in primary spermatocyte metaphase of our species resembles the situation in *N. i. intermedia* (Ramb.) rather than that reported in *N. fulvia* (Dru.) (both from Nepal; cf. KIAUTA, 1975).

TRITHEMIS PALLIDINERVIS (KIRBY, 1889)

Figures 18-19

Material. — 2 ♂, Manila (Rizal Park), 15-V-1979. — [32 complements photographed].

$2n=25$, $n=13$; *m*. — In spite of the appreciable photographic material of reasonable quality, the karyotypic analysis appears difficult and uncertain. This is partly due also to the rather exceptionally small size of all elements.

There are only two micrographs of spermatogonial metaphase in our material, and in none of these could the *m*-chromosomes be discerned. There is only one extremely minute element, weakly stained at this stage, hence we consider it to represent the unpaired X. The other elements are of gradually decreasing magnitude; none is peculiar by its distinct size, therefore the *m*-pair could not be ascertained at this stage (cf. Fig. 18).

At metaphase I, the smallest element seems to represent the X. The second smallest element is at least twice larger. From its apparently bivalent structure we assume it represents the *m*-bivalent (Fig. 19).

The species has been studied earlier from Bombay (ASANA & MAKINO, 1935), Calcutta and Orissa (DASGUPTA, 1957), New Delhi (BAGGA, 1961), and from Dehra Dun (TYAGI, 1978b). While in the Dehra Dun material the X and *m*-bivalent are nearly equal in size at metaphase I, the former is reported and/or figured at least twice as large as the latter from the other four Indian localities. If our interpretation of the Philippine karyotype is correct, this would be another member of the genus showing considerable karyotypic variation on the geographic population level (cf. KIAUTA & BOON VON OCHSSÉE, 1979).

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